

Microwafer™ Data Cartridge

Advance Information



TYPICAL APPLICATIONS

- Portable and "Kneetop" Computers
- Home/Personal Computers
- Word Processors
- Electronic Typewriters
- Smart Telephones
- PBX Systems
- Portable Data Loggers
- Point-of-Sale Terminals

FEATURES

- Up to 144 Kbytes per Cartridge
- Rugged, Compact, Cost-effective
- 10, 20, 35, 50 and 62 Foot Tape Lengths
- Weight: Under 3/4 Ounce
- Unique Sliding Cover for Media Protection
- Integral Write-protect Tab
- Keyed for Foolproof Insertion

GENERAL DESCRIPTION

The Microwafer™ data cartridge holds a continuous loop of magnetic tape for use as a compact, low cost, fast access mass storage medium with maximum unformatted capacity of 144 Kbytes. When formatted in sectors of 512 bytes each, using FM encoding, the Microwafer data cartridge holds up to 128 Kbytes of user data. The medium is compatible with Entrepo's Microwafer drive, and with a data transfer rate of 20,480 bits per second. Using MFM encoding, the data rate and available capacity can be doubled.

Accurate and consistent alignment of the tape to the head is performed dynamically by the mechanical structure of the cartridge. As a result, azimuth alignment is carried with the data cartridge, ensuring interchangeability throughout the population of drives.

The integrity of stored data is ensured in two ways: a cover automatically slides to protect the tape, and a write-protect feature helps prevent accidental erasure. Mechanical design of the Microwafer data cartridge includes strong reinforcement, so that the data cartridge can withstand considerable abuse.

MICROWAFER SPECIFICATIONS

Recommended Conditions

SPECIFICATION	MIN.	TYP.	MAX.	UNITS
Ambient Temperature (Operation)	10		45	°C
Ambient Temperature (Storage)	-20		60	°C
Temperature (Wet Bulb)			30	°C
Relative Humidity (Operating) ⁽¹⁾	20		80	%
Relative Humidity (Storage) ⁽¹⁾	5		95	%
Flux Change Density			3413.4	flux changes per inch
Data Recording Density		1706.7	3413.4	bits per inch
Number of Passes			5000	Passes

Note: 1. No condensation is allowed.

THE ENTREPO MICROWAFER™ RECORDING STANDARD

Data Recording Density	1706.7 bits / inch
Nominal Flux Density	3413.4 flux changes / inch
Encoding	FM

USER WRITE-PROTECTION

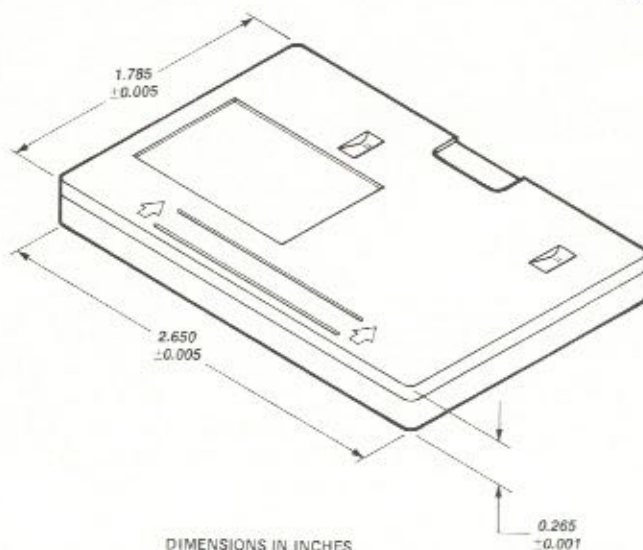
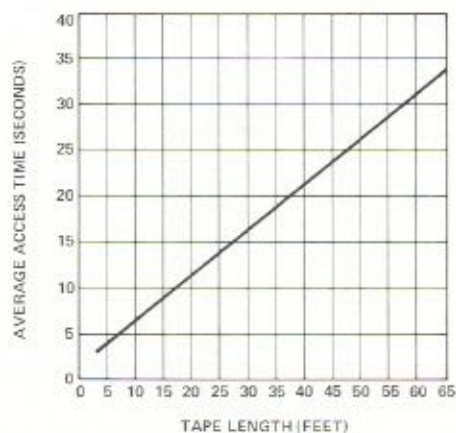
To write protect a Microwafer data cartridge, the user must remove the write protect knockout area, located on the side of the cartridge. A sense switch will detect the missing tab and inhibit writing.

TAPE LENGTHS AND CAPACITIES

PART NUMBER	TAPE LENGTH (Feet)		MINIMUM CAPACITY (Bytes)	
	MIN.	MAX.	FORMATTED (K = 1024)	UNFORMATTED (K = 1024)
700031	10	11	17K	19K
700032	20	22	38K	43K
700033	35	39	70K	79K
700034	50	55	102K	116K
700035	62	69	128K	144K

Note: A gap area is specified for ten inches on each side of the Index. Integrity of data written in this gap cannot be ensured.

AVERAGE ACCESS TIME



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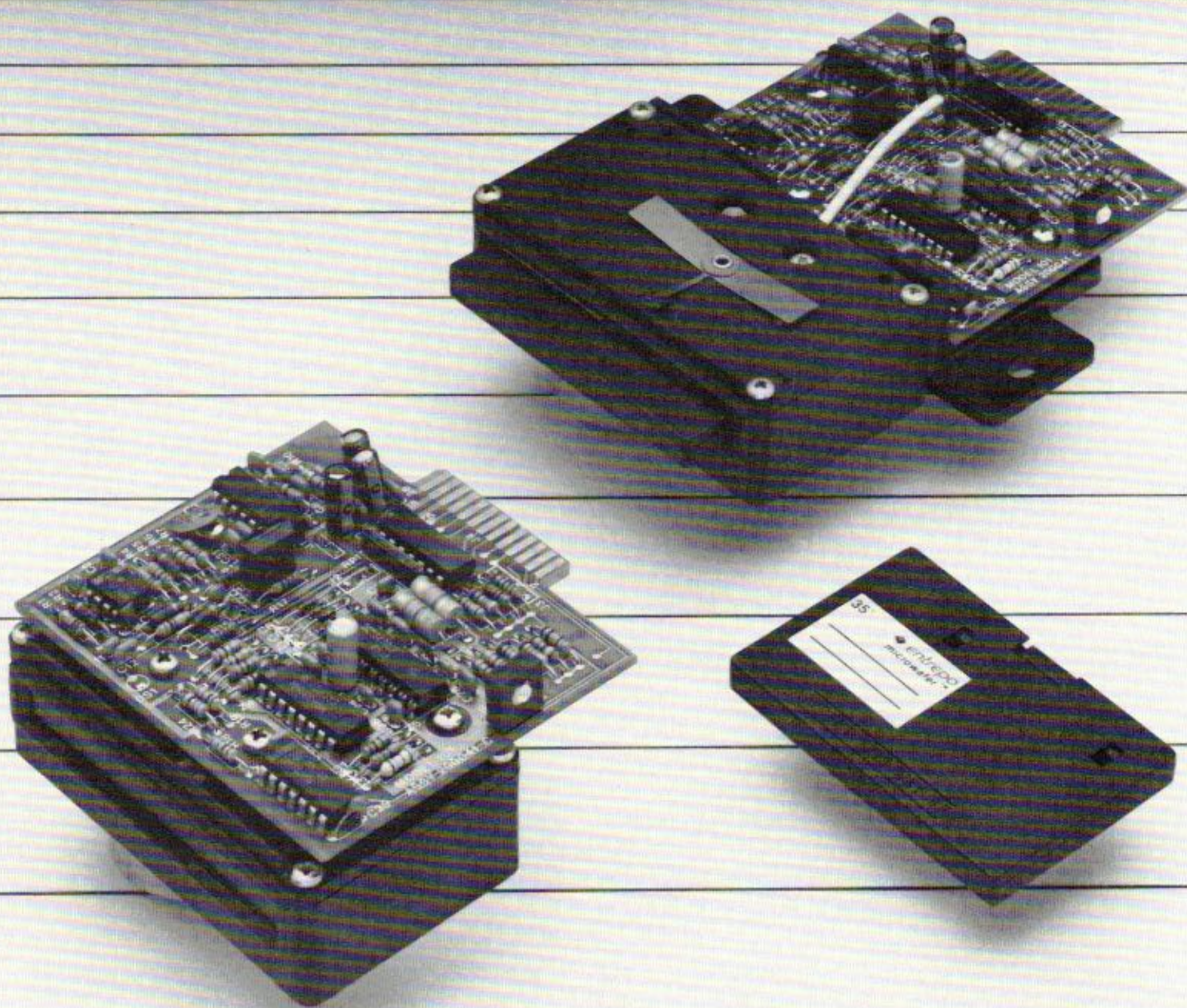
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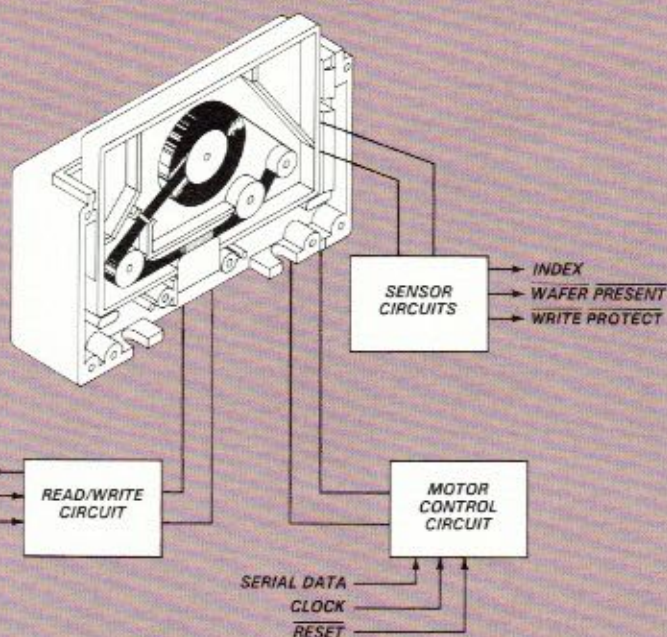
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Model 101 Microwafer™ Drive





FEATURES

- Up to 144 Kbytes per Data Cartridge
- Maximum Data Transfer Rate: 20,480 Bits/Second
- Fast Forward
- Low Power Dissipation
- Compact Design
- 10, 20, 35, 50 and 62 Foot Tapes
- Read/Write Electronics
- Digital Motor Control Circuit
- TTL-Compatible Interface
- Weight:
 - 101-1: (6 ounces)
 - 101-2: (8 ounces)

GENERAL DESCRIPTION

The Entrepo Model 101 Microwafer™ drive is a compact low cost, fast access mass storage device optimized for ease of use in program load and save applications. The drive consists of a Microwafer™ transport with read/write and motor control electronics capable of reading and writing on the Entrepo Microwafer data cartridge with a data transfer rate of 20 Kbits per second.

The Microwafer data cartridge is a continuous loop of magnetic tape in a cartridge with maximum capacity of 144 Kbytes (unformatted) or 128 Kbytes (formatted in sectors of 512 bytes each). The Model 101 can sense the presence of a Microwafer data cartridge, as well as the write protect feature on the cartridge.

The Model 101 Microwafer drive contains the following components:

Transport — Housing with read/write head and motor;

Motor Control — To adjust the speed of the motor and tape when reading, writing and seeking;

Write Circuits — Energizes the read/write head to put flux transitions on the tape;

Read Circuits — Reads the signal off the tape, amplifies it, filters the signal, detects flux transitions, additionally filters it, and supplies the host system with the flux change data.

The Model 101 is available in two form factors. The Model 101-1 has its printed circuit board mounted on top of the transport, while the Model 101-2 features a rear-mounted printed circuit board.

THE ENTREPO MICROWAFER™ RECORDING STANDARD

Format Specifications

Transfer Rate	20,480 bits/sec	nominal
Recording Density	1706.7 bpi	nominal
Flux Density	3413.4 fci	nominal
Recording Method	FM	

Storage Capacity and Average Access Time

TAPE LENGTH (FEET)		MINIMUM CAPACITY (BYTES)		AVERAGE ACCESS TIME (SECONDS)
MIN.	MAX.	FOR- MATTED (K = 1024)	UNFOR- MATTED (K = 1024)	
10	11	17K	19K	6
20	22	38K	43K	11
35	39	70K	79K	19
50	55	102K	116K	26
62	69	128K	144K	32

For more information see Entrepo's Application Note 1, "The Entrepo Microwafer Recording Standard."

FM ENCODING

The data integrity specifications are based upon testing done with FM encoding.

MODEL 101 SPECIFICATIONS

Absolute Maximum Specifications

(These conditions are not suitable for operation. Operations outside these limits may damage the component.)

SPECIFICATION	MIN	TYP	MAX	UNITS
V _{CC}			6.0	Volts
V _{DD} , V _M			15	Volts
V _{INPUT}	-0.5		V _{CC} +0.5	Volts

Recommended Environmental Conditions

SPECIFICATION	MIN	TYP	MAX	UNITS
T _{AMBIENT} (Operation)	10		45	°C
T _{AMBIENT} (Storage)	-20		60	°C
Relative Humidity (Operating) ¹	20		80	%
Relative Humidity (Storage) ¹	5		95	%
T (Wet Bulb)			30	°C

Reliability Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS
MTBF	10,000	20,000		POH (5%DC)
Component Life	5			Years
Flux Change Density			3413.4	Flux Changes per Inch
Error Probability (Soft Errors) ²			10 ⁻⁸	Errors/Bit
Error Probability (Hard Errors) ²			10 ⁻¹¹	Errors/Bit

Notes:

1. No condensation is allowed on the data cartridge.
2. Error Probability is defined as the probability (with implementation of proper write compensation) that a READ DATA pulse will occur outside of the specified timing limits. This Error Probability is based upon testing using FM encoding.

DC Electrical Specifications

SPECIFICATION	MIN	TYP	MAX	UNITS
V _{CC}	4.75	5.0	5.25	Volts
V _{DD}	11.4	12.0	12.6	Volts
V _M	10.8	12.0	13.2	Volts
I _{CC}		100	200	mA
I _{DD}		50	100	mA
I _M (Instantaneous)		40	500	mA
I _M (Read/Write) (Steady-State)		65	200	mA
I _M (Fast Forward)		80	200	mA
I _{IL} (Input Low Current)			-1.6	mA
I _{IH} (Input High Current)			50	μA
I _{OL} (Output Low Current)			1.6	mA
I _{OH} (Output Current at V _{IH} , Non-Open-Collector Outputs)			-200	μA
V _{IH}	2.0		V _{CC}	Volts
V _{IL}	0		0.7	Volts
V _{OH}	2.4		V _{CC}	Volts
V _{OL}			0.4	Volts

Note: All voltages specified above are measured at the J1 interface connector.

Specifications — Motor Control

SPECIFICATION	MIN	TYP	MAX	UNITS
V _{TR} Tape Velocity-R/W	11.5	12	12.5	Inches per Sec.
V _{TFF} Tape Velocity-FF	12	15	17	Inches per Sec.
Time for Speed Stabilization			200	msec
Stop Time			200	msec
Stop Distance			1.0	Inches

CONTROLLING TAPE SPEED

The tape speed is sensed by frequency of MOTOR SPEED pulses, occurring six times per motor revolution. Due to commutator tolerances within a revolution, speed measurements should rely only on the time between every sixth pulse.

The tape speed is controlled by shifting a value into the 8-bit Motor Control Register. Data that is present on the SERIAL DATA input will be clocked into the least significant bit of the Motor Control Register, and each bit that is in the register will be shifted to the next most significant bit position, on the low-to-high transition of the CLOCK input.

The value stored in the Motor Control Register is converted to a voltage and applied to the motor. The host processor can monitor the speed of the tape by measuring the time for six pulses from the motor (MOTOR SPEED) and adjusting the value in the Motor Control Register until the speed is correct.

The following data illustrates typical values of Motor Speed for given values stored in the Motor Control Register. The value will vary depending upon wafer length and temperature.

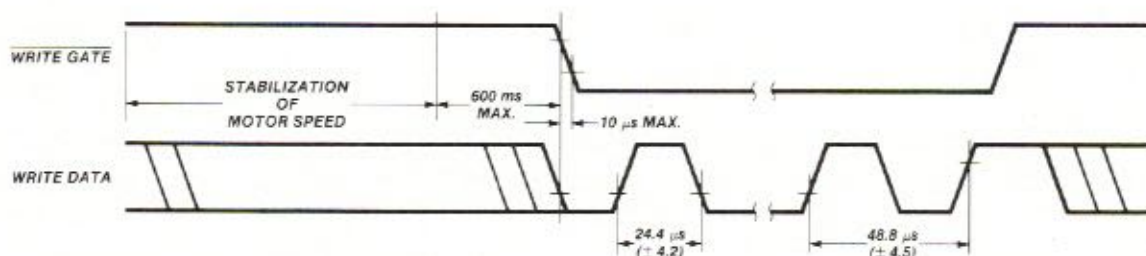
REG. VALUE (HEXADECIMAL)	NOMINAL TAPE SPEED (INCHES/SECOND)
C1	10
D8	12
E8	14

Write Mode

Writing data to the Model 101 is accomplished by moving the tape at the read/write speed, activating the WRITE GATE line, and pulsing the WRITE DATA line with the data to be written.

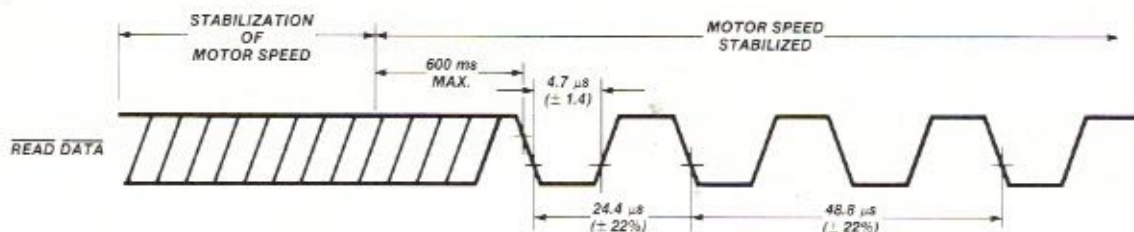
Notes:

1. Transitions of WRITE GATE should occur only in inter-record gaps.
2. The quiescent state of WRITE DATA can be high or low; only transitions between V_{IH} and V_{IL} are important for timing purposes.
3. These specifications for WRITE DATA timing include provision for up to 4 microseconds of precompensation, in addition to allowed jitter.

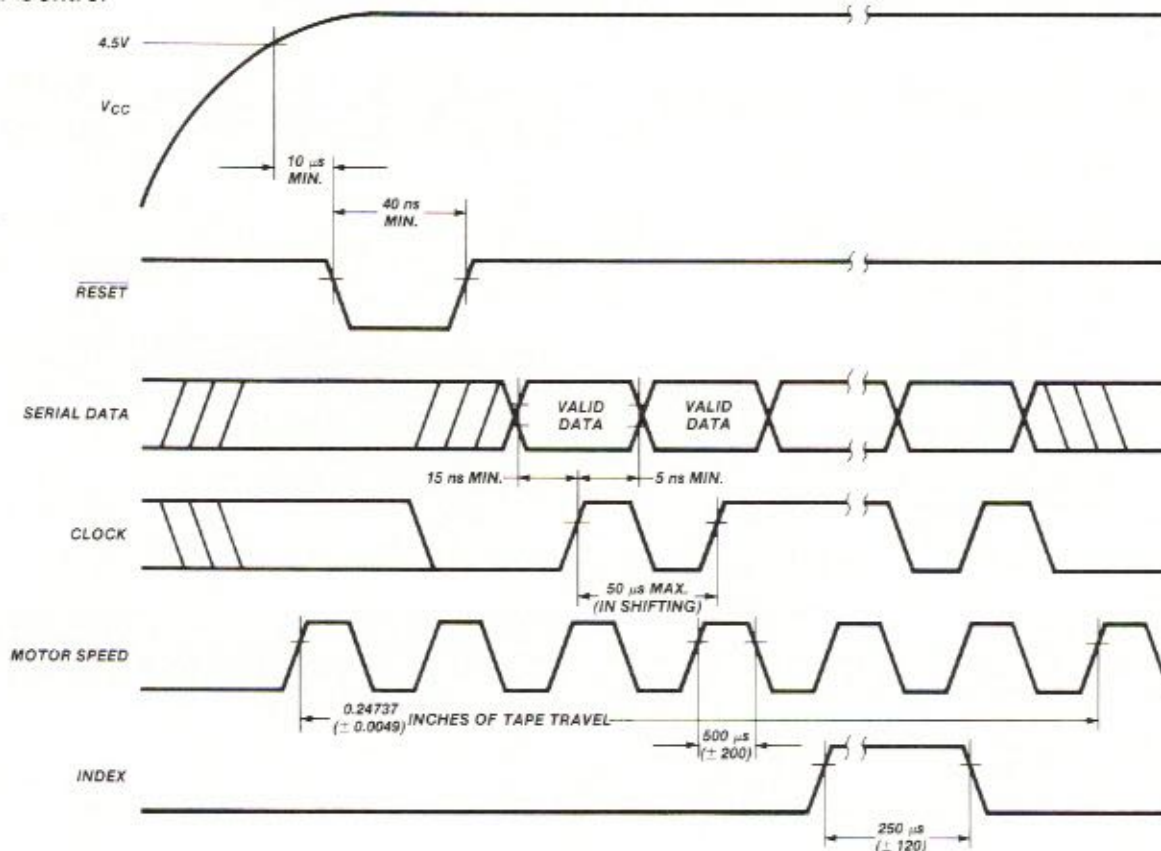


Read Mode

Reading data from the Model 101 is accomplished by holding WRITE GATE inactive (V_{IH}) and moving the tape at the read/write speed.



Motor Control



MODEL 101 INTERFACE SIGNALS

Read/Write Circuit

WRITE GATE (Pin 8)	Input	WRITE GATE enables writing to the data cartridge when active low (V_{IL}).
WRITE DATA (Pin 2)	Input	Provides the data to be written on the data cartridge. Each transition from a logical one level to a logical zero level or vice versa, will cause current through the R/W head to be reversed thereby writing a data bit. This line is enabled by WRITE GATE being active.
READ DATA (Pin 4)	Output Open-Collector	Provides the clock and data pulses as detected by the read circuit.

Motor Control Circuit

SERIAL DATA (Pin 16)	Input	Data input to least significant bit of Motor Control Register.
CLOCK (Pin 12)	Input	Clock input of the Motor Control Register.
RESET (Pin 14)	Input	Reset input to the Motor Control Register. While low, resets Motor Control Register to 0 (placing Model 101 in STOP Mode).
MOTOR SPEED (Pin 20)	Output	The signal is a pulse which occurs six times per revolution of the motor shaft.

Sensors

INDEX (Pin 10)	Output	Active HIGH once each revolution of the tape to indicate the beginning of tape.
WRITE PROTECT (Pin 6)	Output	The WRITE PROTECT signal will be LOW (V_{IL}) when there is no wafer present or when a write protected wafer is in the drive.
WAFER PRESENT (Pin 18)	Output	This signal is LOW whenever a wafer is inserted into the drive.

Power

VCC (Pin 22)	Input	+5 Volts
VDD (Pin 24)	Input	+12 Volts for Linear circuitry
V _M (Pin 26)	Input	+12 Volt Motor Voltage
GND (All odd-numbered pins)	Input	Common ground for Model 101

PHYSICAL INTERFACE

The electrical interface between the Entrepo Micro-wafer drive and the host system is via a single connector. The connector, J1, provides the signal interface, the DC power, and ground.

Connection to J1 is through a 26 pin PCB edge card connector. The pins are numbered 1 through 26, with the even-numbered pins on the component side of the PCB. Pin 2 is labeled, and a key slot is provided between pins 10 and 12 for optional connector keying.

Recommended Connectors for P1

CABLE TYPE	MANUFACTURER	CONNECTOR P/N
Flat Cable	3M	3462-0001
Flat Cable	AMP	499560-5
Flat Cable	Ansley	609-2615M

USER WRITE PROTECTION IN THE MODEL 101

To write protect a Microwafer data cartridge, the user must remove the write-protect knock out area on the wafer. A sense switch will detect the missing tab and inhibit writing, while bringing the WRITE PROTECT line to V_{IL} .

MOTOR CONTROL

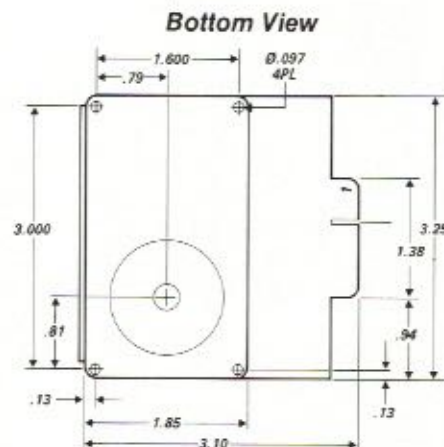
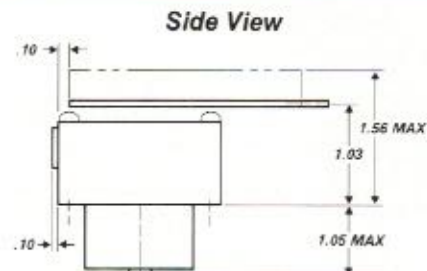
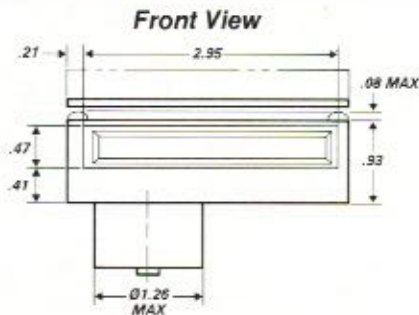
The Motor Control Register controls motor operation in the following modes:

REG. VALUE	MODE
00	Stop
80-FE (Hex)	Regulate Speed
F.C. FF (Hex)	Fast Forward

RECOMMENDED PREVENTIVE MAINTENANCE

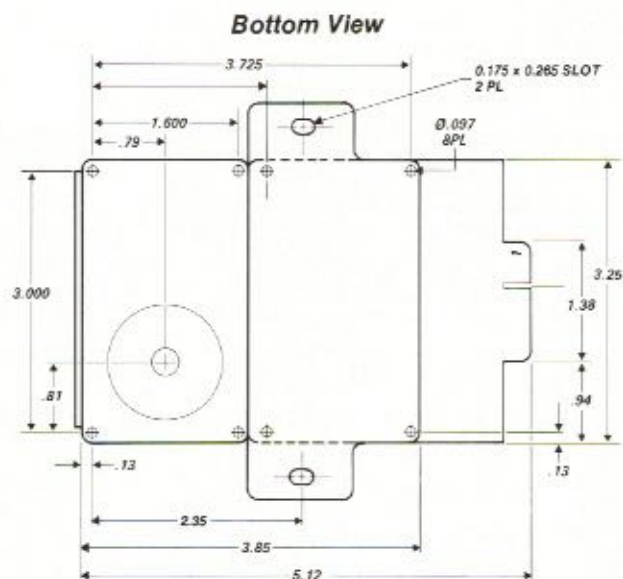
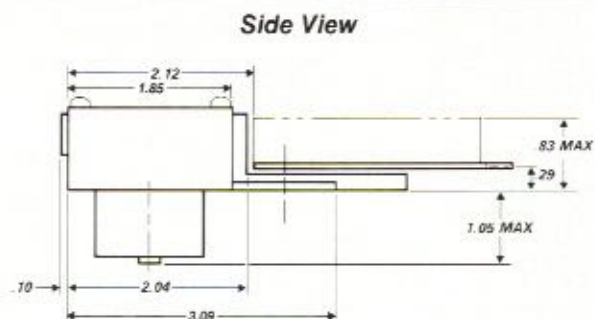
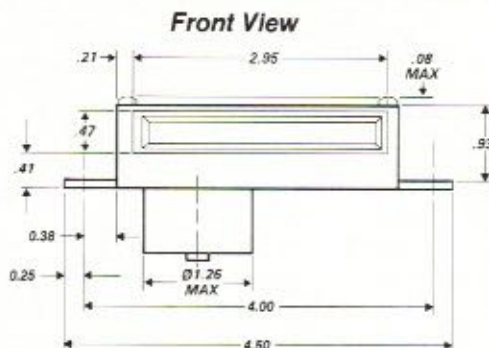
Clean head and capstan after every 5×10^8 bits of data transferred.

MODEL 101-1



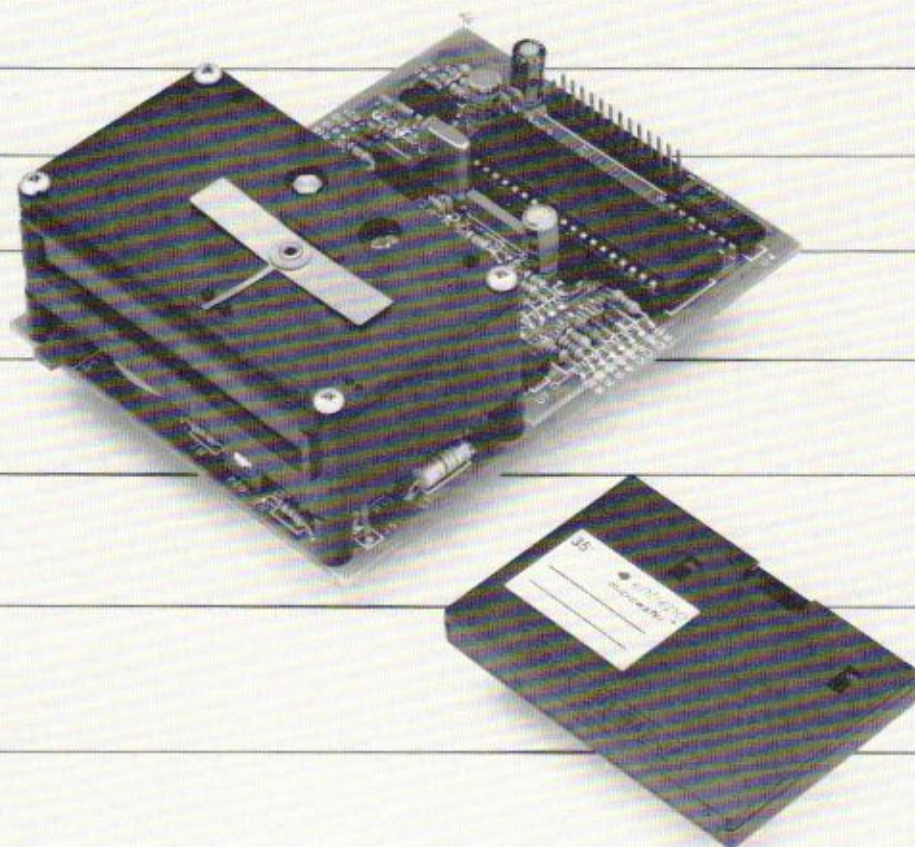
The Model 101-1 forms a compact, lightweight package which is supported, from beneath, by 4 holes in the Microwafer transport. This form factor is useful for designs which allow little depth.

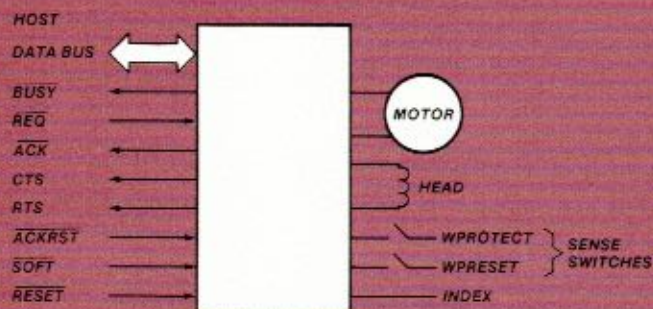
MODEL 101-2



Enhancing the low-profile nature of the Model 101 design, the Model 101-2 features rear mounting of the printed circuit board. Mounting holes on the circuit board bracket allow support from above or from below.

Model 107 Microwafer™ Drive





FEATURES

- Integral Drive and Controller
- Up to 128K Bytes per Tape
- Soft-sectored Format Capability
- Multiple Sector Reads and Writes
- Byte Parallel TTL Interface
- 10, 20, 35, 50 and 62 Foot Tapes
- Write Precompensation
- Automatic Motor Shutoff
- Cleaning Wafer Operation

GENERAL DESCRIPTION

The Entrepo Model 107 Microwafer™ drive is a compact low cost, fast access, mass storage system optimized for ease of interface in program load and save applications. The system consists of a Microwafer™ transport, read/write, motor control, sensor electronics, and microcomputer on a circuit board that provides a reliable, inexpensive mass storage subsystem.

The Model 107 Microwafer™ drive is capable of reading and writing on the Entrepo Microwafer™ cartridge, a continuous loop of magnetic tape in a rigid plastic case. It has a maximum capacity of 148,348 bytes unformatted or 128 Kbytes formatted in 512 byte sectors.

Simple to use, the controller has just ten commands:

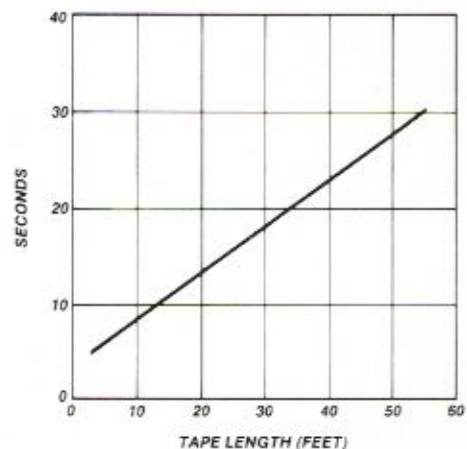
CONTINUE	— Reads, writes or verifies the next consecutive sector
READ	— Reads a sector from the wafer
WRITE	— Writes a sector onto the wafer
VERIFY	— Reads a sector and confirms data integrity
STATUS	— Returns the tape controller status
REWIND	— Positions the tape at the index
SEEK	— Positions the tape at a specified sector
FORMAT	— Formats the tape
MOTORON	— Turns the motor on
MOTOROFF	— Turns the motor off

MODEL 107 SPECIFICATIONS

Minimum Storage Capacity (K = 1024 Bytes)

LENGTH OF TAPE FEET	LENGTH OF SECTOR					
	128	256	512	1024	2048	4096
10	15K	16K	17K	18K	18K	16K
20	34K	37K	38K	39K	40K	40K
35	63K	68K	70K	72K	72K	72K
50	91K	98K	102K	105K	106K	104K
62	114K	123K	128K	131K	132K	132K

Average Access Time



MODEL 107 SPECIFICATIONS (continued)

Absolute Maximum Specifications

(The conditions are not suitable for operation. Operations outside these limits may damage the component.)

SPECIFICATION	MIN	MAX	UNITS
V _{CC}	-0.3	6.0	Volts
V _{DD}	-0.3	15	Volts
V _{INPUT}	-0.3	V _{CC} + 0.3	Volts

Recommended Environmental Conditions

SPECIFICATION	MIN	MAX	UNITS
T _{AMBIENT} (Operation)	10	45	°C
T _{AMBIENT} (Storage)	-20	60	°C
Relative Humidity (Operating)	20	80	%
Relative Humidity (Storage)	5	95	%
T (Wet Bulb)		30	°C

Reliability Specifications

SPECIFICATION	MIN	MAX	UNITS
MTBF	10,000		POH ^[3]
Component Life	5		Years
Hard Error Rate ^[2]		10 ⁻¹¹	Errors/Bit
Soft Error Rate ^[2]		10 ⁻⁸	Errors/Bit

Notes:

1. This product has circuits for protection from high static voltages and high electric fields. However, do not apply voltages more than the maximum ratings to these high input impedance protection circuits. To assure the normal operation we recommend:

$$V_{SS} \leq (V_{IN} \text{ or } V_{OUT}) \leq V_{CC}$$

2. Error probability is defined as the probability that a bit will be read incorrectly.

3. Power On Hours with 5% duty cycle for motor operation.

ELECTRICAL CHARACTERISTICS

DC Characteristics (V_{CC} = 5.0V ± 5%, V_{SS} = 0V, T_A = 10°C to 45°C)

ITEM	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply (+12V)	V _{DD}		11.4	12	12.6	V
Power Supply (+5V)	V _{CC}		4.75	5	5.25	V
Current Dissipation (+12V)	I _{DDFF}	Fast Forward		80	200	mA
Current Dissipation (+12V)	I _{DDRW}	Read/Write		65	200	mA
Current Dissipation (+5V)	I _{CC}			30	60	mA
Input "HIGH" Voltage	RESET*	V _{IH}	V _{CC} - 0.5		V _{CC} + 0.3	V
	Other Inputs	V _{IH}	2.0		V _{CC} + 0.3	V
Input "LOW" Voltage	V _{IL}		-0.3		0.8	V
Input Current High Input (RTS, REQ*, SOFT*, ACKRST*, (DB ₀₋₇))	I _{IH}	V _{IN} = V _{CC} - 0.5V			1.0	μA
Input Current Low Input	RTS, REQ*, SOFT*, ACKRST*	I _{IL}	V _{IN} = 0.5V		-0.2	mA
	(DB ₀₋₇)	I _{IL}	V _{IN} = 0.5V		1.0	μA
Three State (Off-State) Leakage Current (DB ₀₋₇)	I _{TS}	V _{IN} = 0.5 to V _{CC} - 0.5V			1.0	μA
Output "HIGH" Voltage	V _{OH}	I _{OH} = -200 μA	2.4			V
	V _{OH}	I _{OH} = -10 μA	V _{CC} - 0.7			V
Output "LOW" Voltage (All Outputs)	V _{OL}	I _{OL} = 1.6 mA			0.55	V
Input Capacitance (except RESET*)	C _{IN}	V _{IN} = 0V, T _A = 25°C			12.5	pF
Input Capacitance (RESET*)	C _{IN}	V _{IN} = 0V, T _A = 25°C			10	μfd

General Specifications

ITEM	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Flux Change Density	f _{CI}	Sector Read or Write	3,282	3413.4	3,556	Flux/Inch
Bit Rate	bps	Read or Write	19,692	20,480	21,353	Bit/Sec.
Byte Rate	BPS	Read or Write	2,461	2,560	2,667	Byte/Sec.
Recording Density (FM Encoding)	bpi		1,641	1,706.7	1,778	Bit/Inch

Motor Control Specifications

ITEM	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Tape Velocity Read Write	VTR	Sector Read or Write	11.5	12	12.5	In./Sec.
Tape Velocity Fast Forward	V _{FFF}	Rewind	12	15	17	In./Sec.
Start Time	V _{ST}	1st Readable Sector		700	800	msec
Start Distance	D _{ON}	1st Readable Sector		8.0	9.5	Inch
Stop Time	T _{OF}	Fast Forward to Stopped		100	200	msec
Stop Distance	D _{OF}	Fast Forward to Stopped		1.0	1.5	Inch

HARDWARE DESCRIPTION

The Model 107 contains these main components:

Write Circuitry — Energizes the read/write head to put flux transitions on the tape.

Read Circuitry — Reads the signal off the tape, amplifies it, filters the signal, detects flux transitions, additionally filters it, and supplies the controller with the flux change data.

Motor Control — Adjusts the speed of the motor via a closed loop servo technique and operates the motor at full speed during searches and rewind to index.

Controller contains:

Data Separator — Converts the FM signal from the tape into 1's and 0's.

Mark Detector — Finds special data encodings that identify the beginning of ID blocks and DATA blocks.

Deserializer — Accumulates 1's and 0's into bytes.

Serializer — Converts bytes to 1's and 0's.

FM modulator — Takes 1's and 0's and converts them to an FM signal to be written on the tape.

Motor Controller — Participates in the servo loop for the motor speed controller.

Formatter — Generates a beginning-of-tape gap, a string of sectors, and an end-of-tape gap.

Command Interpreter — Decodes commands from the host that activates the various sections of the controller.

Sector Locator — Finds a specified sector by repeatedly reading ID blocks.

Check Generator — Generates a 16-bit checksum that is appended to the data written onto the tape.

Error Detector — Checks the data on the tape for errors.

Read Sector Control — Activates the sector locator and transfers data from the data deserializer to the host.

Write Sector Control — Activates the sector locator and transfers data from the host to the serializer.

Connector

The connector is a 26 pin header with 0.1 inch spacing. A typical mating connector is a Berg 66902-X26.

Handshake

The controller handshake may be operated in two modes:

Pulse: $\overline{\text{ACKRST}}$ is tied to ground. The $\overline{\text{ACK}}$ signal from the controller to the host will be a pulse with duration of 0.5 to 1.5 μsec . This mode is useful if the $\overline{\text{ACK}}$ signal is received in a clock of a flip-flop.

Level: $\overline{\text{ACKRST}}$ is held high. A pulse from the LSI controller sets the flip-flop (see Figure 1) that drives $\overline{\text{ACK}}$ low. The host resets the flip-flop before the next transfer by pulsing $\overline{\text{ACKRST}}$. This mode is useful if the $\overline{\text{ACK}}$ line is polled in software.

Preventive Maintenance

To insure meeting the hard and soft error rates, clean the head and the motor capstan once every 5×10^8 bits transferred (approximately once a month with a 7 hour day, 5% duty cycle).

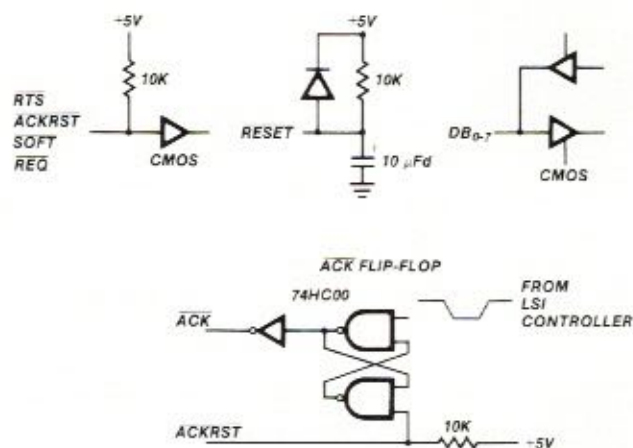


Figure 1. I/O Circuit Equivalents.

MODEL 107 INTERFACE SIGNALS

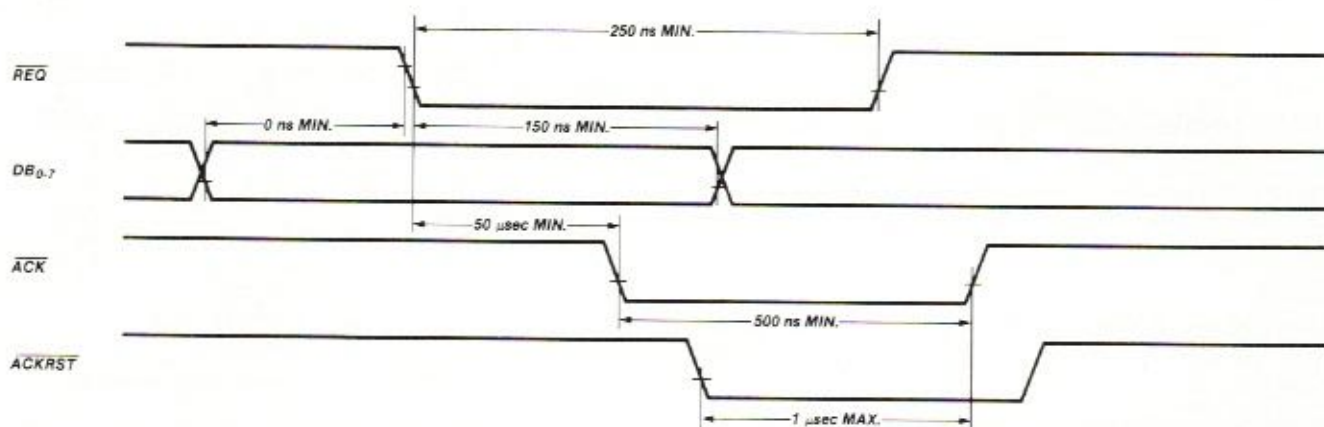
Connector to the Host Microprocessor

NAME	PIN NO.	TYPE	FUNCTION
GND	1		GROUND
ACKRST	2	In	ACKNOWLEDGE RESET — When low, causes the acknowledge latch to be reset. If tied low, the ACK line will provide pulses instead of levels.
GND	3		Ground
ACK	4	Out	ACKNOWLEDGE — Signals to the host processor that the controller has placed data on or removed data from the Data Bus.
CTS	5	Out	CLEAR TO SEND — Signals to the host processor that the direction of the parallel bus is outward from the host and that the controller is prepared to receive data, commands, or parameters.
BUSY	6	Out	BUSY — When low indicates to the host processor that the controller can accept another command.
GND	7		GROUND
RTS	8	In	REQUEST TO SEND — When high, signals to the controller that it may turn the line around from output from the host to input to the host.
DB ₇	9	I/O	DATA BUS BIT 7 — Used for transferring commands and status between the controller and the host processor.

NAME	PIN NO.	TYPE	FUNCTION
DB ₆	10	I/O	DATA BUS BIT 6
DB ₅	11	I/O	DATA BUS BIT 5
DB ₄	12	I/O	DATA BUS BIT 4
GND	13		GROUND
DB ₃	14	I/O	DATA BUS BIT 3
DB ₂	15	I/O	DATA BUS BIT 2
DB ₁	16	I/O	DATA BUS BIT 1
GND	17		GROUND
DB ₀	18	I/O	DATA BUS BIT 0
GND	19		GROUND
RESET	20	In	RESET — When low initializes the wafer subsystem to its power on state.
+5	21		+5 Volts
SOFT	22	In	SOFTWARE RESET — On the falling edge causes the controller to abort its current operation, send a zero byte to the host, and return to the ready for command state.
+5	23		+5 Volts
REQ	24	In	REQUEST — On the falling edge latches commands or data on the Data Bus into the controller or signals the controller that data has been taken off of the bus.
+12	25		+12 Volts
+12	26		+12 Volts

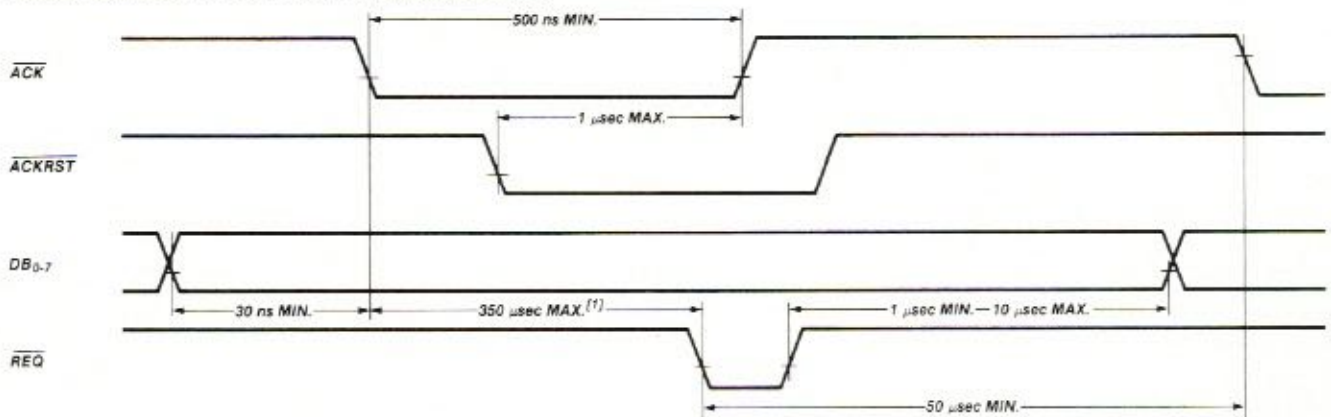
MODEL 107 TIMING

Data/Command/Parameter Output from Host to Controller

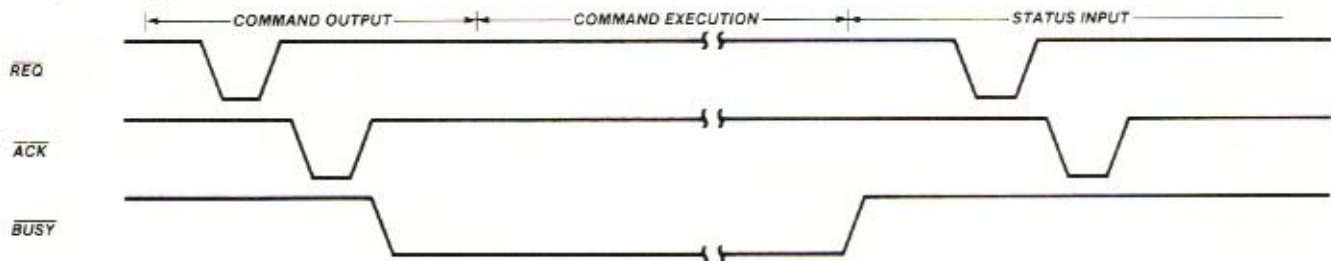


MODEL 107 TIMING (continued)

Data/Parameter Input from Controller to Host



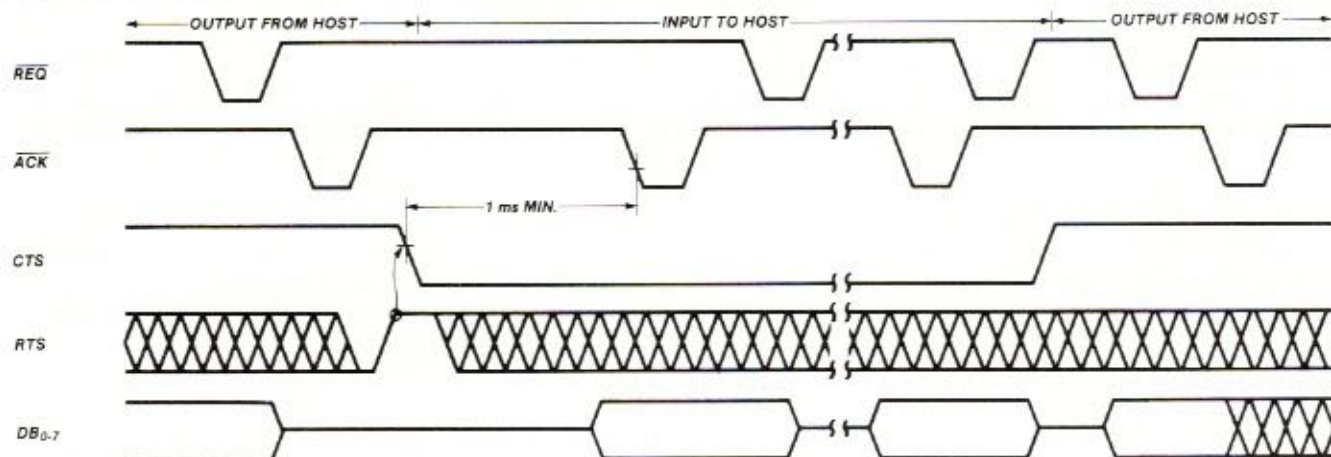
Busy Timing



Power on Timing



Line Turn Arounds



Note:

1. When reading or writing parameters, the controller performs a complete data handshake on each byte, i.e. there is no time requirement for the host, so the host response time is not critical.

However, when transferring data during a read or write sector, the controller, which contains no data buffering, requires service from the host at the rate at which bytes are transferred to and from the tape. The interface signals appear to

go through the complete handshake sequence. However, the controller ignores the request pulses from the host, assuming that the data has been transferred. Should the host lag behind the 350 μ sec requirement, due to other interrupts in the system for instance, the host and the controller will typically disagree on the number of bytes transferred and the protocol will hang up. Therefore, it is imperative that the host keep its write sector and read sector transfer loops short and shut off any interfering interrupts.

Parallel Interface Transfers

To write a command, parameter, or data byte to the controller, the host puts the byte on the data bus, DB₀₋₇, and pulses the REQ line. This will latch the byte into the controller. Subsequently, the controller processes the byte and returns a pulse on the ACK line indicating that the byte has been input to the controller and another byte can be put on the data bus.

For bytes to be transferred from the controller to the host, the controller places the byte on the data bus,

DB₀₋₇, and pulses the ACK line. The host reads the data bus, then pulses the REQ line to indicate that the byte has been taken and another can be placed on the data bus.

Recording Format

Data is recorded on the Microwafer™ cartridge using frequency modulation as the recording mode. The format is similar to the IBM soft sector format for flexible disk. Details are described in Entrepo Application Note 1.

COMMAND SUMMARY		PARAMETERS WRITTEN TO THE CONTROLLER	DATA AND STATUS RETURNED TO THE HOST
CONTINUE	0	None or DATA (Write Continue)	STATUS or DATA, STATUS (Read Continue)
READ SECTOR	1	SCTR-MSB, SCTR-LSB, LNG-MSB, LNG-LSB	DATA, STATUS
WRITE SECTOR	2	SCTR-MSB, SCTR-LSB, LNG-MSB, LNG-LSB*, DATA	STATUS
VERIFY	3	SCTR-MSB, SCTR-LSB	STATUS
RETURN STATUS	4	None	STATUS
REWIND	5	None	STATUS
SEEK	6	SCTR-MSB, SCTR-LSB	STATUS
FORMAT	7	I, LNG-MSB, LNG-LSB*	TTL-MSB, TTL-LSB, STATUS
FORMAT ?	7	154	LNG-MSB, LNG-LSB, TTL-MSB, TTL-LSB, I, R, STATUS
MOTORON	8	None	STATUS
MOTOROFF	9	None	STATUS

LNG-MSB = Most significant byte of the sector length in bytes.
 LNG-LSB = Least significant byte of the sector length in bytes*
 I = Interleaving factor
 S = Status
 DATA = The data bytes of the sector
 TTL-MSB = MSB of total number of sectors on the tape

TTL-LSB = LSB of total number of sectors on the tape
 SCTR-MSB = Most significant byte of the sector number
 SCTR-LSB = Least significant byte of the sector number
 R = Reserved byte

*LNG-LSB must be an even number on FORMATS and WRITES.

COMMANDS

The host sends a single command byte to the controller to initiate a command.

The command byte consists of a unit number field and a command field.



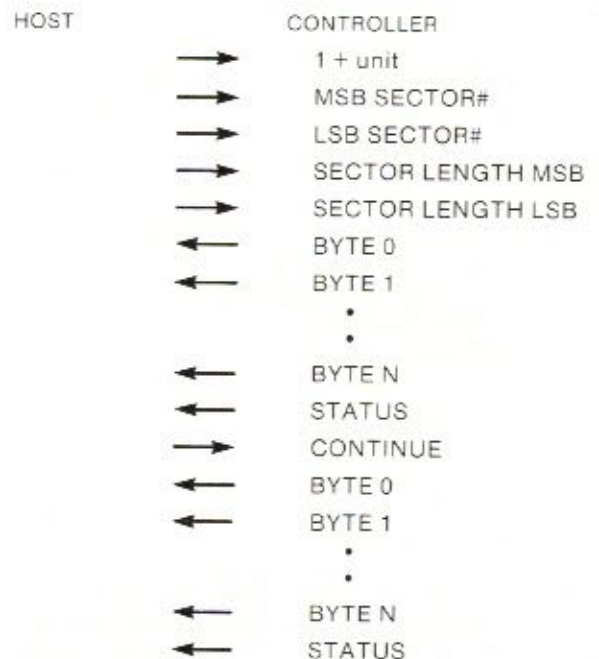
The 107 is a single drive controller and only responds to a 00 in the unit number field.

Continue



Output to the controller after STATUS is received during a read, write, or verify causes the operation to be repeated with the next higher sector number.

Read Sector(s)

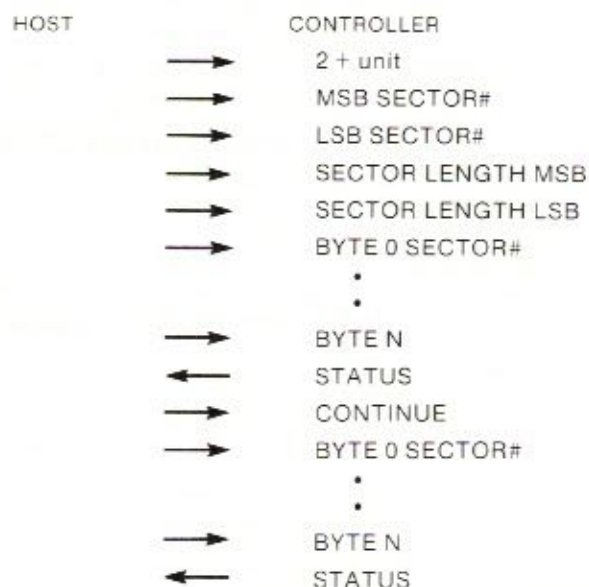


COMMANDS (continued)

READ SECTOR searches for the specified sector, reads the sector, sends the sector to the host, and sends the status. If an error is found the controller will still transfer data bytes to the host, however, these bytes may be in error, i.e. the number of bytes transferred to the host is fixed regardless of the success or failure of the command.

If the host responds with a CONTINUE command, the motor will remain on and the next consecutive sector number will be read. If no other command is received, the motor will shut off after approximately one-half second.

Write Sector(s)

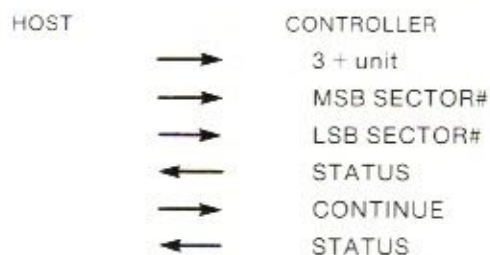


WRITE SECTOR searches for the specified sector, writes the specified sector, and sends status to the host.

If the host responds with a CONTINUE command, the motor will remain on and the next consecutive sector number will be written. If no other command is received, the motor will shut off after approximately one-half second.

The sector length must be an even number.

Verify



The controller seeks to the specified sector and checks the data in the sector for errors.

After the sector is checked, status is returned to the host. If a CONTINUE is sent from the host to the controller, the motor will be left running and the next consecutive sector number will be verified.

If no other command is received, the motor will shut off after approximately one-half second.

Return Status



STATUS returns the status from the previous command.

When there is no wafer in the unit, the status will be "no wafer present".

When a wafer is inserted, the status will change to "new wafer inserted". The status will stay at "new wafer inserted" until a non-status command is executed.

See Table A for a listing of the status values.

Rewind



REWIND spaces to the tape INDEX mark at fast forward speed.

The motor is then set to Read-Write speed. If no other command is received, the motor will shut off after approximately one-half second.

Seek



Positions the tape at the specified sector number. Since all the other read and write operations contain an implied seek, the SEEK command does not need to be used.

The next sector that can be read or written without going all the way around the tape is a stop distance plus a start distance from the beginning of the specified sector.

The motor is left at read-write speed. If no command is received, the motor will shut off after approximately one-half second.

Format



Writes beginning of tape gap. Writes ID marks, ID field, data marks, data fields initialized to 0's, gaps and end-tape gap.

Legal interleaving factors are 1 to 127 where 1 consecutively numbers physically adjacent sectors.

The sector length must be an even number.

The tape is formatted with sectors numbered in the order specified by the interleaving factor. For example, if there are 300 sectors on the tape and the interleaving factor is 2, then the first sector number will be zero, the next on the tape will be 150, the next 1, 151 and so on. The last two sector numbers would be 149 and 299.

After a format operation, all sectors contain zeroes.

The total number of sectors that were written on the tape is returned as a two byte number.

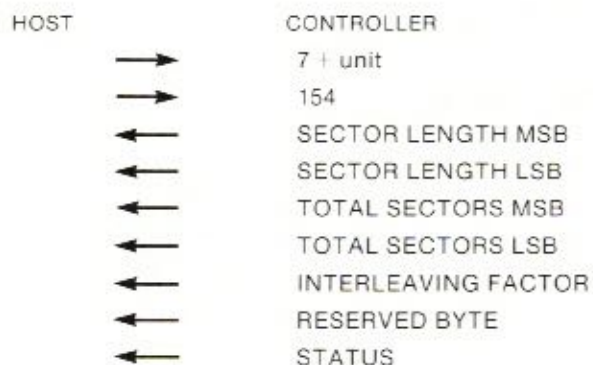
Interleaving Factor

1 = Consecutively numbered sectors occupy consecutive positions on the tape.

2 = Consecutively numbered sectors occupy every other sector.

3 = Consecutively numbered sectors have two sectors in between them. etc.

Format ? (query)



The controller determines the physical layout of the sectors on the tape and returns this information to the host.

Motoron



Turns on, and leaves on the motor at read/write speed until another command is issued. MOTORON does not shut the motor off after one-half second of command activity as do the other tape movement commands (READ, WRITE, VERIFY, REWIND, FORMAT, SEEK).

Motoroff



MOTOROFF turns off the motor. It is useful for eliminating the one-half second of motor operating after a tape movement command.

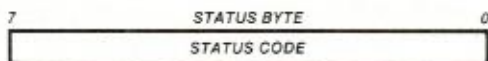
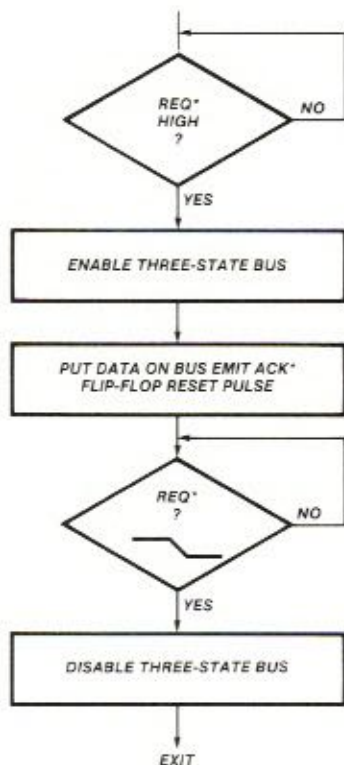


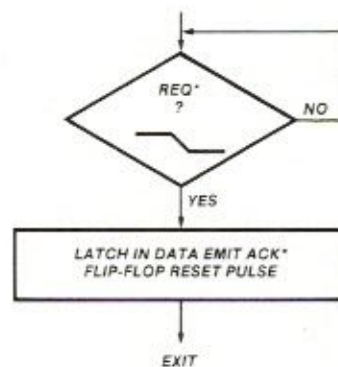
Table A. Status Values

S = 0	Operation complete, no error
S = 1	No command in progress
S = 2	Wafer is write protected
S = 3	Unimplemented command
S = 4	No such unit #
S = 5	Length parameter is out of range
S = 6	Non-existent sector
S = 7	Reserved
S = 8	Reserved
S = 9	Unable to find index in 1 minute
S = 10	Motor speed not adjustable
S = 11	Attempt to write odd number of bytes
S = 12	Unable to find a sector in two tape passes
S = 13	Write tried past index
S = 14	EOT gap too long
S = 15	Attempt to read or write unformatted tape
S = 16	CRC error during read of an ID field
S = 17	Length of the sector on the tape and the calling length parameter do not agree
S = 18	Interleaving factor out of range
S = 19	New wafer inserted
S = 20	No wafer in unit
S = 21	Error detected during read of data
S = 22	No signal on tape
S = 23	Motor is stalled

Controller Logic that Sends Parameters and Status to the Host



Controller Logic that Accepts Commands or Parameters from the Host



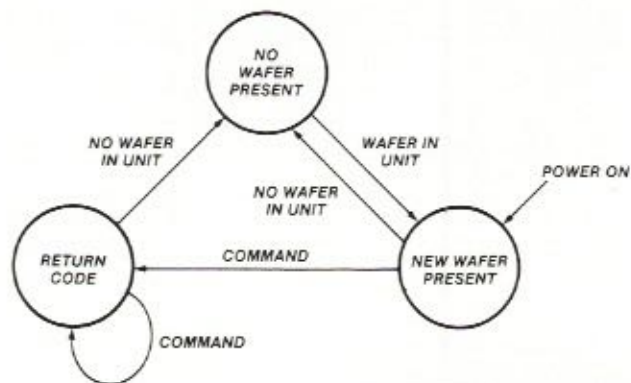
OTHER FUNCTIONS

Power On Reset — The controller clears all internal storage, sends a zero byte to the host and waits for a command.

Cleaning Sequence — Upon insertion of a special cleaning wafer, the controller detects its presence and runs the motor for 30 seconds.

Software Reset — Similar to the power on reset, the control resets some of its internal storage, leaving unchanged the parameters of the currently inserted wafer. A zero byte is sent to the host to indicate completion of the reset sequence.

Status Codes



Typical Command Sequence

ACKRST		Clears \overline{ACK} flip-flop if it were left low by the previous operation.
SOFT		Aborts any command in progress, i.e. resets the controller to a known state.
INPUT BYTE		Get the byte that indicates the end of the soft restart sequence.
WAIT FOR CTS HIGH		Indicates that the controller is ready to receive the command.
OUTPUT COMMAND BYTE		
OUTPUT PARAMETER/ DATA BYTE(S)		
INPUT PARAMETER/ DATA BYTE(S)		
INPUT STATUS		
EXIT		

Typical Output Byte Routine

PUT DATA ON BUS

\overline{REQ}

WAIT FOR \overline{ACK} LOW

DISABLE TRI-STATE DRIVERS

\overline{ACKRST}

\overline{REQ}

EXIT OUTPUT
BYTE ROUTINE

Enable tri-state drivers outward from the host.

Indicate to the controller that data is on the bus.

Indicates the controller has latched in data.

Clear the \overline{ACK} flip-flop.

Indicate to the controller that the host is done with the output byte sequence.

Typical Input Byte Routine

WAIT for \overline{ACK} LOW

LATCH IN DATA OFF THE BUS

\overline{ACKRST}

\overline{REQ}

EXIT INPUT
BYTE ROUTINE

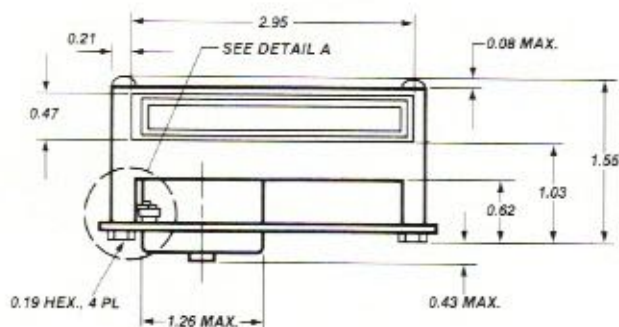
Shows that data has been put on the bus by the controller.

Reset the \overline{ACK} flip-flop.

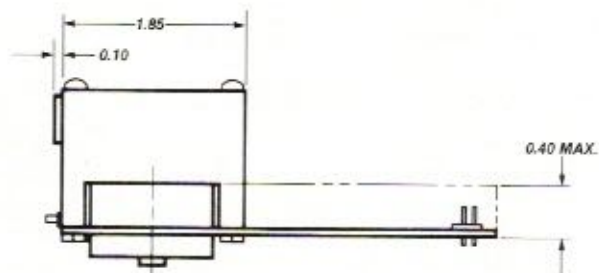
Tell the controller that the byte was accepted.

MODEL 107

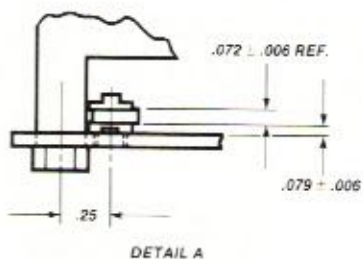
Front View



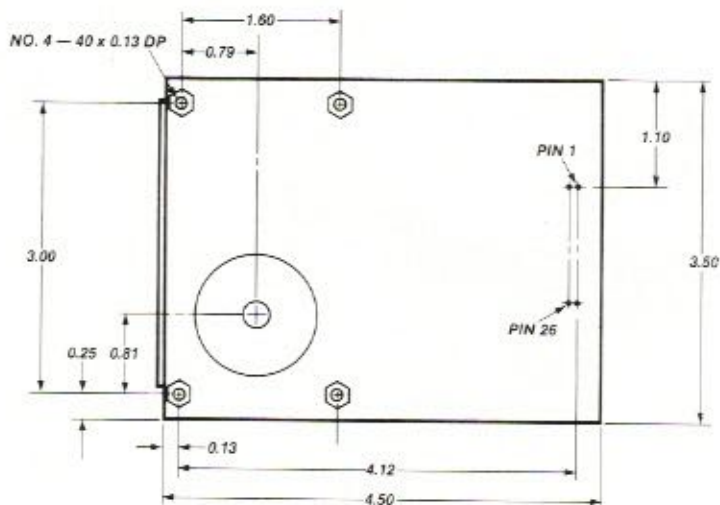
Side View



LED Placement



Bottom View



DIMENSIONS ARE IN INCHES



PRICE SHEET

EFFECTIVE JUNE 1, 1984

ITEM	QUANTITY*						
	1-9	10-49	50-99	100-499	500-999	1000-4999	5k-10k
MODEL 101-1 read/write top mount	\$93.60	\$70.42	\$47.10	\$40.41	\$31.46	\$28.33	\$23.62
MODEL 101-2 read/write rear mount	\$97.50	\$73.35	\$49.06	\$42.09	\$32.77	\$29.51	\$24.61
MODEL 101-3 read/write bottom mount	\$101.40	\$76.28	\$51.02	\$43.77	\$34.08	\$30.69	\$25.59
MODEL 007 controller chip	\$50.00 [†]	\$35.45 [†]	\$22.48 [†]	\$19.00 [†]	\$14.51 [†]	\$12.98 [†]	\$10.72 [†]
MODEL 107 controller with read/write	\$150.00 [†]	\$109.46 [†]	\$86.17 [†]	\$60.45 [†]	\$46.55 [†]	\$41.75 [†]	\$34.62 [†]

ITEM	QUANTITY*			
	1-9	10-49	50-99	100-499
MODEL 007P EPROM controller chip	\$110.00	\$92.50	\$83.75	\$75.00
MODEL 017P EPROM controller board	\$135.00	\$125.00	\$115.00	\$110.00
MODEL 107P controller with read/write	\$200.00	\$150.00	\$125.00	\$115.00

ITEM	QUANTITY*						
	100-499	500-999	1000-4999	5k-10k	10k-50k	50k-100k	100k-500k
MICROWAFER™ data cartridge 10 foot	\$1.98	\$1.80	\$1.73	\$1.60	\$1.54	\$1.43	\$1.38
MICROWAFER™ data cartridge 20 foot	\$2.02	\$1.84	\$1.77	\$1.64	\$1.58	\$1.46	\$1.41
MICROWAFER™ data cartridge 35 foot	\$2.06	\$1.88	\$1.81	\$1.67	\$1.61	\$1.49	\$1.44
MICROWAFER™ data cartridge 50 foot	\$2.10	\$1.92	\$1.85	\$1.70	\$1.64	\$1.52	\$1.47
MICROWAFER™ data cartridge 62 foot	\$2.14	\$1.96	\$1.88	\$1.73	\$1.67	\$1.55	\$1.50

* minimum order \$100
[†] available Quarter 4, 1984

Prices Subject to change without notice.

Contact factory for quotations in larger quantities.





⑤	electron
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TR5. 80 ADD-ON

